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Teachers (/teachers/)



Instructable #2 in my series on biodiesel.

This is my tutorial for using my appleseed processor (https://www.instructables.com/id/Make-Your-Own-Biodiesel-Processor/) to make biodiesel. This tutorial will get you through the process of making biodiesel, but not the necessary washing process. I will do my next instructable on dry-washing biodiesel.

Biodiesel is a great way to go green, and cut your carbon footprint quite substantially, not to mention it's cheaper than diesel. Biodiesel will run in a diesel engine, I don't recommend trying it in a gas engine.

The process for making biodiesel uses an oil, a catalyst, and an alcohol. In this

Mer-Chevy Project: Engine Pull Day (/id/Mer-Chevy-Project-Engine-Pull-Day/) by bennelson



hybrid car project (/id/hybridcar-project/) by grannyjones (/member/grannyjones/)



How to Make your Own Biodiesel: (/id/How-to-Makeyour-Own-Biodiesel/) by reinmoose16

case: Waste vegi oil (WVO), NaOH (lye), and methanol.

Please read up on this before you start, and please understand the chemical dangers involved in this process.

Step 1: Safety



First off, some disclaimers and safety info.

NaOH (or KOH, depending on your catalyst of choice) is extremely caustic and will cause extreme irritation if it comes into contact with your skin, eyes, or any other part of you. Methanol is a harmful alcohol. It will cause blindness or death if ingested; one way it's absorbed into your body is through your skin, so simply handling the stuff with bare hand is bad for you. Lastly, Methoxide, the substance produced when you mix your catalyst with the methanol, is an extremely toxic nerve agent. It can do some serious bodily damage.

BE CAREFUL

I use a chemical resistant p100 respirator when I do this process, as well as eye protection. I use some heavy-duty chemical-proof gloves from Northern Tool. Long sleeves are recommended.

Step 2: Necessary Supplies

Before you make the fuel you need to **filter your oil**. I filter mine down to 50 microns. I know people who don't filter at all and some people who filter as fine as 10 microns. One person I know simply lets it settle for a few days and disposes of the sludge that settles on the bottom. To filter it I just hung a bag filter above a clean 5 gal. bucket. I used an old sock to get out the large particles before it went through the filter.

For the actual making of the fuel you will need:

- an appleseed processor (https://www.instructables.com/id/Make-Your-Own-Biodiesel-Processor/)

-WVO (you'll get as much fuel as the amount of WVO you use) You can get this from restaurants, but you need their OK before you take it. You will get arrested and get in a pile of trouble if you just take the oil. Avoid burnt oil, as this will not react to make biodiesel. Most fast food places burn their oil.

-A catalyst: NaOH (sodium hydroxide) or KOH (potassium hydroxide) The difference? well, KOH dissolves better in the methanol and NaOH tends to make the final byproduct (glycerin) more congealed. Also, you use different amounts depending on which you go with. NaOH is cheaper, and that's why I went with it.

-Methanol

Methanol is used for race car fuel, and can be purchases at many chemical supply places. This is the most expensive part of the process. Methanol is at about \$5 a gallon. This still ends up being cheaper than regular diesel, since you add 20% methanol for the amount of WVO you use.

Safety equipment you'll need:

-chemical resistant p100 respirators Got 2 at Lowes for \$25-\$30 each

-lab goggles

-chemical resistant gloves

(http://www.northerntool.com/webapp/wcs/stores/servlet/product_6970_2003144 20_200314420)

What you'll need for the titration:

-Isopropyl alcohol get this at an auto parts store

-distilled water

-a very tiny bit of your catalyst (NaOH or KOH)

-a sample of your WVO

-3 oral syringes Get these at the drug store

-Phenol Red indicator (like for testing your pool water)

Step 3: Filter the WVO





I'm going to leave the collection part up to you, I'm just going to tell you what to do with the oil once you have it.

You should get it in Carboys, it's easiest to use this way.

my basic setup is very low tech, just a bag filter hung from a broom stick over a clean bucket. I used a sock this time around to try and get a longer life out of my filters. I have on clean carboy I put some oil in, and put the rest in another bucket.

Some people like to heat their oil before they filter it. Probably not a bad idea, and I may do this in the future.

Do not use any crappy oil that looks like a cloudy mess at the bottom of the oil. You can see it in one of my pictures. It has water in it, and will ruin your reaction, avoid using this at all costs.

Step 4: Titrate Your Oil





This is where we test the acidity of the oil, by measuring the free fatty acids, to see how much NaOH is needed for the reaction.

Start by measuring out 1 gram of NaOH and mixing that with one liter of the distilled water. This gives you a 1/1000 solution. Keep this, you won't use it all on one titration.

Next measure out 10 milliliters of the isopropyl and 1 milliliter of your WVO sample. Mix these in the same jar. Now add about 5 drops of Phenol Red indicator to this solution; swirl to get it mixed. Fill the last syringe with your lye/water solution and add 1/4 milliliter at a time while swirling the jar. Once it turns bright pink and stays that way you need to count exactly how many milliliters of lye/water solution you used to neutralize the acidity of the oil.

Now we can use this information to tell us how much NaOH to use in the reaction.

The formula is this:

For NaOH- # of liters of oil x 4 grams + titration

For example, say I titrated at 2 milliliters and was using 50 liters of oil. I would do 50 x 6=300. 300 grams of NaOH for that batch.

Step 5: Prep the Oil



Take a carboy filled with oil and connect a section of hose from the carboy to the intake valve on your processor.

Use hose clamps to secure the hose to the carboy lid with the ball valve on it. Be sure to have primed the pump.

Now open the valve on the carboy and the intake valve. Turn on the pump and make sure the glycerin drain and out-take valve are both closed, so oil doesn't come shooting out.

At this point it is very important to have the pressure vent on the processor open, this way you can leave the valve nearest the processor tank closed and let as much oil as you can be sucked though the intake point and get pumped into the tank. Also, be sure to have the vent on the back of the carboy open, or you'll create a vacuum and the carboy will implode.

Once all the oil is in the tank you can turn on the element. If you're using more

than 5 gallons of oil you obviously will need to disconnect the hose and repeat more than once.

Heat the oil to 130 degrees F. (you can open the drain valve, get a quick sample, and use a quick-read thermometer to check.)

Step 6: Methoxide Mixing and Introduction to the WVO

This is the most dangerous part of making the fuel.

Measure out 20% of the total volume of oil worth of methanol into a carboy with a vent. (1 gallon of methanol per 5 gallons of oil and so on.)

Be wearing eye protection, chemical resistant gloves, and a respirator at this point.

Measure out the calculated amount of catalyst and put it in/on a coffee filter or something that you can dump quickly. Dump the catalyst into the carboy and immediately screw on the same lid or same kind of lid as shown in the previous step, the one with a ball valve on it.

Shake vigorously and crack the valve open away from you and other people. It will hiss. Shake it up some more, to be sure you get things dissolved all the way. You may need to vent it once or twice more to release the pressure.

Hook this up the same way you did the carboy with the oil. Make sure it's all very tight and secure, you don't want this stuff leaking. leave the intake valve closed for now. Open the valve on the carboy and remove the vent cap so there is a slight bit of air coming into the carboy as some of the liquid trickles down the hose.

Open all the valves in the circuit on the processor and start the pump again so the oil is circulating. Leave the element on.

Now very very slowly crack the intake valve so the methoxide is introduced very very slowly. If you introduce it too quickly it will make soap. Not what we're shooting for here. Tilt the carboy to make sure all the methoxide drains out. Close the intake valve.

Double check the pressure vent on the processor. chemical reactions are happening and the pressure needs somewhere to go.

Let this go for about an hour before you consolidate it all in the tank. Let it sit with the element on for the next 12-14 hours.

Step 7: Draining the Glycerin



The main byproduct of biodiesel is glycerin. You put in 20% methanol, and get out 20% glycerin. Glycerin is useful, and can be used to make soap and things. You can also compost it. Just be sure to boil off any leftover methanol before you use it. There may be some unreacted catalyst, too.

After 12-14 hours it should be separated out. Open the valve nearest the tank and make sure the valve on the other side of the drain is closed, then slowly open the drain valve. Drain into a bucket until what's coming out changes color. At this point you've drained the glycerin and have reached the fuel. Drain the fuel into a separate bucket/container.

Step 8: What's Next?



Now all you need to do is wash your fuel before you can put it in a car. There are several methods to wash fuel, and if you use water you need to be sure to dry it. I'm dry-washing my fuel. Dry-washing uses Magnesol (http://www.fryerpower.com/store/), and it uses no water.

My next instructable will deal with the washing process.

Please don't run unwashed fuel in your car, and please don't forget to dry/filter after you wash.

Now I know some of you are wondering about this, and yes, I am going to add a methanol recovery system. As soon as I add the larger tank I'm adding that and some other upgrade type things.

Cheers!

-DMC

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Comments



00	where would i get ethanol online at cheap rates	2017-02-04	Reply
	FancyPatato (/member/FancyPatato/) ▶ juggadmaster Try Aliexpress or cheap wodka.	r (/member/juggadmaste 2017-04-11	er/) Reply
	<pre>stib (/member/stib/) If you're making biofuel from waste products good on y biofuel is the 'green' solution to everyones transport no parade a bit. Biofuel sounds like a good idea until you consequences of it a little. Like the way it's pushing up (http://news.bbc.co.uk/2/h the price of food (http://www.guardian.co.uk/business/2007/jul/05/energ world (http://news.cnet.com/8301-11128_3-9918741-5 producing food crops uses about 2.3 times more fossi (http://www.harpers.org/archive/2004/02/0079915)ene energy they provide. Looks like I can swap destroying the climate with my of </pre>	2008-05-29 you, but if you think eeds I have to rain start thinking abou hi/business/6481029 gy.environment)aro 54.html), and the fac il fuel ergy to grow than th car for causing glob	Reply on the t the 9.stm) und the ct that le
	 drinkmorecoffee (/member/drinkmorecoffee/) > stib (One word: Algae. Biofuels from food crops- bad from non-food sources- the way of the future. Linky6 (/member/Linky6/) > drinkmorecoffee (/member/ 	(/member/stib/) idea, biofuels /drinkmorecoffee/)	Reply 08-05-29 Reply 16-10-14
	 Please can I get your contact(facebook account, whatsapp) stib (/member/stib/) > drinkmorecoffee (/member/drinkm/Well, biofuels from non food crops sounds good, who were growing food crops realise there's moder crops and give up growing food. It's not rocket side conomics 101. If everyone switches to biofuels the world's rainforests goodbye. Biofuels from all promising, but then there will be impacts on martakes a lot of area to power the private car fleet. 	, mail or orecoffee/) , until farmers re money in growin urgery, it's market we can kiss the las lgae does sound ine environments. I with plant based so	Reply 08-05-30 g fuel st of t just purces.
	But you know I use biofuel for most of my transp ride a bike. drinkmorecoffee (/member/drinkmorecoffee/) > stib	(/member/stib/)	Reply

Yes, but algae can be grown in the middle of nowhere. The fact ²⁰⁰⁸⁻⁰⁵⁻³⁰ that soil conditions matter a lot less with algae means it doesn't have to take up food crop land, or rainforest areas. There's still plenty of ground to cover, but algae is very promising.



smithy813 (/member/smithy813/) > drinkmorecoffee (/member/drinkmorecoffee/)

2008-05-30 Reply

actually, soil conditions don't matter at all to algae, because it grows in the WATER, thats right, not the middle of nowhere, the middle of the OCEAN, its actually a promising idea, I've heard of it before. About the farmers switching to it, most like there land, not the ocean, I'm sure that a new job niche will only do good things for the economy (now, I've tried to make this neutral enough so that I don't spark a huge debate, but, in advance, sorry if i offend anyone)



drinkmorecoffee (/member/drinkmorecoffee/) ▶ smithy813 (/member/smithy813/) Well, the most promising way to grow it right now is in tanks, above ground. No harvesting required. This could be done in the middle of nowhere, somewhere where the soil is no good for growing food-crops.



nathanielg (/member/nathanielg/) > drinkmorecoffee (/member/drinkmorecoffee/) remember we can always go down or up so we could have tanks stacked on top of eachother 10 stories down and 10 stories up, that would reduse the surface area of the tanks on land by 95%



servant74 (/member/servant74/) > drinkmorecoffee (/member/drinkmorecoffee/)

I like the one where they use overgrown plastic baggies²⁰⁰⁸⁻⁰⁷⁻³⁰ Reply hung row after row, with the algae solution pumped into the top and it slowly winds its way to the bottom. Still has big tanks to drain it into, but it does allow for circulation and central harvesting / maintenance / feeding. Some bloke in El Paso TX seems to have come up with it, but they are still working on which is the most profitable strain of algae for them. personally I have seen plenty of swimming pools and ponds that could use to have some cleaning done ... at least there the algae could be used rather than just thrown / flushed away if algae harvesting was easy to do.



 bingo1912 (/member/bingo1912/) > smithy813 (/member/smithy813/)
 Reply

 OI VEY! soylyent green!
 2011-03-10



odiekokee (/member/odiekokee/) > stib (/member/stib/)

2015-04-07 Reply

Overpopulation is going to destroy man-kind far before climate change. Thank the good folks who are against contraception and work so hard for disease control for that.



servant74 (/member/servant74/) > stib (/member/stib/)

2008-07-30 Reply

yep, but riding bikes on a 50 mile one way commute in Houston TX or LA kind of sucks. ... such is life for those outside the sweet spot areas where walking, bicycling, or even train commuting is an option.



lol, perhaps your problem was taking a job that required communing 100 miles a day.





look in the world for civilizations to grow they need some form of an economic platform, most turned to a

2011-07-09 Reply

form of capitalism (since theoretically it works). Now not just with capitalism, any form of economic growth system needs an infinite plan of resources and time. Why this has to do with fuel sources like gasoline, the modern civilizations have been accelerated by the growth of a commodity. If you look at the word commodity, it implies the function of running out. Onto what i was wanting to really say, the problem with a national grid and a local grid is you are still using a polluting resource that is the problem. Also Without an national grid, there is no form of transportation between city's. Now with a local grid, these would be so hectic to run, most areas don't have fuel sources, there would be little to no imports and exports, areas that were once inhabited could not (nevada) due to resources, and if you had a large central city where people of the surrounding area lived there this city would be so large to not even travel without some form of a motor vehicle.

(Jac)	bingo1912 (/member/bingo1912/) 	2011-03-10	Reply
8-4 8-4	Pkranger88 (/member/Pkranger88/) ▶ stib (/member/stib/) So you've made complaint. What's your solution, all w	2008-05-30 <i>v</i> ise and know	Reply
100	T2Pogi (/member/T2Pogi/) stib (/member/stib/) There are many sources of veggie oil and tapping into no greatly impact the food situation. There is jatropa s (many countries in asia have a surplus capacity of thi re "unhealthy" oils), and of course, there is the waste consumers like us. now if you are talking about ethan may be right. that route is apparently not the way to g	2008-05-29 o these source seeds, coconu s oil due to the oil for small ol from corn, y o.	Reply es will t oil e scare
mje I us was tran Iano	Iderd (/member/mjelderd/) e to own and operate a commercial Biodiesel facility. W ste oil from the restaurants, filtered, refines and used it f isportation. All of the product was waste that would have dfill or sent overseas to make Biodiesel that was shipped	2016-02-04 e picked up th or home heatin e been sent to d back to the l	Reply e ng and a JSA.
AlexB The rolli cau you som on o	145 (/member/AlexB145/) made it! the people that shouldn't drive diesels are the ones that the ng coal and do it excessively giving us truck owners a be sing the government to enforce emission control. Oh still r bike 700miles to work or would you rather be eating in the people that drive that far to work are the people that bor they make it able for you to buy tires for your bike.	2015-11-17 ink its cool to b ad name and b would you ri the dark beca keep your elec	Reply De de ause stricity



(https://cdn.instructables.com/FX9/4OJY/IH3OY8MX/FX94OJYIH3OY8MX.LARGE.jpg)



AlexB145 (/member/AlexB145/)

2015-11-17 Reply

The people that shouldn't drive diesels are the ones that think its cool to be rolling coal and do it excessively giving us truck owners a bad name and causing the government to enforce emission control. Oh stib would you ride your bike 700miles to work or would you rather be eating in the dark because some people that drive that far to work are the people that keep your electricity on or they make it able for you to buy tires for your bike.



AlexB145 (/member/AlexB145/) made it!

2015-11-17 Reply

Theirs ups and downs about biodiesel yes i drive a gas truck and I kick myself for not buying a diesel because while I'm pulling 29ft trailer averaging 8mpg making 700miles my friend pulls a 29ft trailer same weight and same trailer runs biodiesel and averages 25mpg. Some people should drive diesels and some people shouldn't but its a free country we can do whatever we want and in todays we do what we can to survive even if that means destroying the world more for are off springs so we can survive and money is your survival kit.



(https://cdn.instructables.com/FX9/4OJY/IH3OY8MX/FX94OJYIH3OY8MX.LARGE.jpg)



Dude...it took me a minute to figure out how you got six for your 50 X 6 = 300. You've got to follow the PEMDAS order of operations. The 4 + 2 should have been in (parentheses) to equal 6. The answer should have been 202 the way you had it set up. And how did you get the 4? Is that a constant no matter if it's 50 liters or 500 or 5000 liters? I'm new at this, but I have the knowledge of math and chemistry to make it happen. Thanks.



Two 55 gal hot water heaters for processing. I diaphragm pump for collection. A dedicated collection truck.



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Sun Gear (/member/Sun+Gear/)

2012-04-17 Reply

very well done. i have been doing reseearch into biodiesel and subsicuentally i ahve stumbled upon algae biodiesel. The process is the same from what i ahve found but instead ot methanol you use ethanol. This site http://www.oilgae.com/ is loaded with information for algae biodiesel, you can even use the algae to make ethanol too!



theturn (/member/theturn/)

2012-04-17 Reply

Don't forget to adjust for purity of your catalyst : In many cases its dificult to get 100 % pure catalyst (NaOH or KOH) Divide your base (4 grams in above example) by purity. If NaOH is used and its 90% pure divide 4 by 0.9 = 4.44 and add this to your titration result using above example $(4.44 + 2) = 6.44 \times 50 = 322g$ needed. Failing to do this, you could leave free fatty acids (FFA) in your processor / finished biodiesel because you didn't account for purity and add enough



00

How To Guy (/member/How+To+Guy/)

2008-09-28 Reply

How is biodiesel worse for the environment? Diesel is a fossil fuel. Biodiesel isn't. Besides, I wish all exhaust smelled like greasy french fries.

bingo1912 (/member/bingo1912/) > How To Guy (/member/How+To+Guy/)

Reply

The main reason they are saying that bio diesel is bad for the environment is not true. what is bad is raising crops and using the oil for fuel instead of human consumption. When this happens the price if food goes up and less land is used for the production of food.. As our population grows so does the amount of land we use to live on, decreasing the amount of farmland. Couple that with the fact that more and more small farmers are leaving the farms. Hug a farmer. they are a dying breed



mr.space (/member/mr.space/) ► How To Guy (/member/How+To+Guy/)

Reply 2008-12-28

the fact that its a fossil fuel doesn't make it worse for the environment, only certain fossil fuels are worse for the environment, the good thing about biodiesel is that it can be made out of waste products and wont run out...like fossil fuels



psi3000 (/member/psi3000/)

2011-01-07 Reply

WARNING!!! You imply that your p100 respirator will protect from Methoxide, when in fact IT WILL NOT!! NO RESPIRATOR WILL. Only fresh air supply will. Just a heads up. The best thing to do is mix the Methoxide and make the bio diesel outside with the wind blowing in the right direction. I wish there was a respirator that could help as this is the only thing holding me up from making my own bio diesel. I have everything to my my processor even and I stopped when I found this out.

phucall-fitz (/member/phucall-fitz/)

2010-06-24 Reply

hi tufrat look on the journey to forever web site it gives covertion tables for both koh and naoh. Its agood site for allthings earh friendly. regards

dsandds2003 (/member/dsandds2003/)

2008-10-12 Reply

is the Methanol the same as they use for the E-85 cars?What is kinda ironic is when they were first building tractors they came with a 3-way valve. These old tractors used gasoline,kerosene and diesel. Now we use entirely different engines. As a matter of fact before gasoline was popular most engines ran on moonshine....Think about it????

drinkmorecoffee (/member/drinkmorecoffee/) ► dsandds2003 (/member/dsandds2003/) 2

2008-10-13 Reply

E-85 is Ethanol. Different stuff. And do not, whatever you do, buy an E-85 vehicle. Any car with a gas engine can run E-85. Car manufacturers slap an E-85 sticker on a car and charge a butt-load of money for it.

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